thickening of the nasal lining-membrane, whether it be due to chronic inflammation affecting it throughout its entirety, or localised to some particular portion, by narrowing the air-way, prejudices the voice, and frequently causes premature fatigue of the voice when it is used. Impairment of the function of the nose as a resonator may also result from swelling of the highly vascular erectile tissue over the anterior end of the inferior spongy bones and from deflections of the septum—the dividing cartilage of the nose. Thickenings or hypertrophies in the neighbourhood of the posterior openings of the nose, especially of the glandular structures situated in the walls of the pharyngo-nasal space, give rise to a similar deadness of tone, and prevent those who are thus affected from appearing as vocalists. Imperfections in pronunciation such as are due to lisping, stuttering, and the like, and imperfections caused by physical deformities as cleft palate, all of which are so readily recognised by an experienced ear that physical examination is superfluous, need not here be further considered. In like manner enlargement of the tonsils—enlarged, it may be, as a congenital condition, or as the result of repeated attacks of inflammation—render speech thick and the voice "throaty," both characteristic of this condition. In a lesser degree thickening of the faucial pillars similarly affects the voice and prevents the free easy movements of the soft palate and the pillars necessary to successful vocalisation. A relaxed state of the palate or paresis of the palate, and elongation of the uvula, either from increase in its constituent tissues (hypertrophy), or from a relaxed condition of its covering mucous membrane, both interfere with the production of voice. The uvula, when elongated, may be found on examination resting as it were on the tongue, or it may in certain positions extend to the larynx, where it causes constant irritation, a frequent, tickling, "unsatisfactory" barking cough, and if left alone will give rise to local hyperæmia, which may permanently injure the voice. The buccal pharynx, that part of the back of the throat seen on looking through the widely opened mouth, is the place of origin of many conditions which give the would-be singer annoyance. Those conditions may range from a slight engorgement of the vessels—a congestion, resulting, it may be, from a slight cold in the head, to a thicken-

ing, or hypertrophy, of the submucous glandular tissue, a condition described under various names, amongst them "granular" or "clergyman's" sore throat. As it occurs most markedly in those who are accustomed to strain the voice in the open air, it may quite as appropriately be termed hawkers' or costermongers' sore throat.

The presence of those conditions so distinctly debars one from taking any prominent part where the voice is called into play, that before any attempt is made at voice-training those imperfections must be removed. But there are other conditions, which though less prominent, are still equally prejudicial to clear vocalisation. And first there is the shape and position of the epiglottis to be considered. Where the epiglottis stands upright and where its curve is wide, sounds produced by the vibrations of the vocal cords escape freely and clearly. On the other hand, if the epiglottis be elongated and dependent, resembling the lid of a box half raised, or if it be folded on itself like a "conduplicate" leaf-bud,[1] the air forced through the larynx impinges on this obstruction, and the clearness of the resulting note is marred. When the epiglottis thus, as it were, overshadows the larynx, it may simply form a mechanical obstruction, or, and this is frequently the case, the laryngeal surface of the dependent epiglottis may become hyperæmic or inflamed during the use of the voice, and the resulting congestion spreads to the laryngeal mucous membrane producing huskiness. The ary-epiglottic (aryteno-epiglottidean) folds may be thickened, and so may the ventricular bands, and of these latter parts I wish to speak more in detail.

The ventricular bands, described at one time as the false vocal cords, consist for the most part of a reduplication of the mucous membrane which covers the larynx, with some fibrous tissue between the folds. This mucous membrane and the fibrous tissue may be hypertrophied (cases of this I have observed occurring after scarlet and enteric fevers as well as from other and local causes), when the ventricular bands become fuller, more prominent, and of a

[1] "Conduplicate" is a botanical term used to describe the condition where the leaf-bud is folded perpendicularly at the mid-rib, and the lateral halves are placed face to face, as in the oak-leaf.

deeper colour. These hypertrophied bands overhang and obscure the vocal cords in great part; and during phonation they may actually meet in the middle line, when rough husky voice is the result. But a condition which gives much more trouble to the singer and which is of much more common occurrence, is a relaxed state of the mucous membrane covering these bands. Here, in using the voice, it is clear to begin with, but the singer, as he continues, finds it necessary to clear the throat frequently, and if he persists in singing he becomes husky, a huskiness which no amount of coughing will clear away. This may appear in a slight form and associated with a relaxed state of the lining membrane of other parts of the throat as the result of a catarrh or cold in the head, and if the larynx be not rested it may become more or less a permanent state. We have this relaxed condition, and in a chronic form, in those who use the voice carelessly, or who require to speak or sing loudly, especially if this is done in the open air, or in an impure atmosphere, be it in a badly ventilated hall or dusty workshop. The inner borders of those relaxed ventricular bands come to rest on the vocal cords and mechanically interfere with their free movements. There is also an increased secretion of mucus from these bands, and this is still further increased during the use of the voice, proving a source of great discomfort.

Lastly, we have certain conditions of the vocal cords as hindrances to clear vocalisation. During the course of a common cold the vocal cords may become injected, their mucous covering swollen, and the bands appear rounded and red in place of being flat and white. In this state they do not approximate accurately during attempted production of voice, and the resulting sound is rough and hoarse. If during such a condition the larynx be not rested, the vocal cords may not regain their normal healthy appearance but remain somewhat rounded and coloured, and under such circumstances clear vocalisation is almost impossible. A condition somewhat similar to this is met with as a congenital condition, where in addition to the thickening of the vocal cords they are rough and irregular in outline, and the voice as a consequence is rough and harsh. This is found in an extreme form in the

majority of deaf mutes, and the like harsh disagreeable tones are noticed in many who have been taught the use of the voice by lip reading.

Apart from diseased conditions (œdema, infiltrations, ulcerations, the presence of new growths, and the like), these are the commoner causes which prevent the production of clear voice, and on account of which you may be consulted. The "grosser" lesions to which I referred must be remedied before clear speech, not to mention the singing voice, is possible. Nasal polypi must be removed and the area from which they spring cauterised, in order, as far as possible, to prevent recurrence. Deflections of the septum should be rectified; hypertrophies of the lining mucous membrane of the nose, or of the erectile tissue over the anterior extremities of the inferior turbinated bones must be reduced, in order that nasal respiration be unimpeded, and that the cavity may be useful as a resonator. It is absolutely necessary that enlarged tonsils be removed, and any obstruction occurring in the pharyngo-nasal space must also be cleared away. When the uvula is elongated, whether it be relaxed or hypertrophied, as it is a source of continual discomfort to the patient, it must be snipped. In doing so, be content to remove a portion only. In granular pharynx, as a most important feature in any form of treatment you may adopt, rest of the voice must be insisted upon. In like manner where there is congestion of any portion of the larynx, rest and local sedatives are called for. Where there are hypertrophies, such may be reduced by regulated exercise when of recent origin; by counter-irritation or destruction of certain parts by the cautery if of a chronic character. In the chronic relaxation of the ventricular bands spoken of, the application of the electric cautery is, from the resulting cicatrisation, of the very first importance, as by this sufferers may have clear voice restored to them. Where the vocal cords are inflamed local sedatives of various kinds given by inhalation will be used with benefit; and when the cords are relaxed, stimulants, similarly applied, will go far to give relief. But the importance of rest must always be placed prominently before the sufferer as a *sine qua non* to complete recovery.

The question of the use of alcohol and tobacco requires to be carefully considered when directing treatment for any condition

associated with voice-production. It is a subject which has been much written about, and the opinions and practices of many noted vocalists have been placed before the profession. Shortly, one may say that as rest for the part is recommended during the course of any condition interfering with clear vocalisation, so anything which acts as a local irritant should at that time be prohibited. If either alcohol or tobacco is indulged in by voice-users, it should at all times be to a very limited extent, and in the least irritating form; but whatever the patient's habits may be, if the condition of the fauces, pharynx, or larynx, calls for rest, alcohol and tobacco should be prohibited.

# NOTE ON THE STEREOPHOTOCHROMOSCOPE—A NEW OPTICAL INSTRUMENT.

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I had lately, in London, the opportunity of examining, through the kindness of Mr Ward, who is acting for the inventor, Mr Frederick E. Ives of Philadelphia, an instrument of great interest to physiologists, inasmuch as it has been devised upon data directly deducible from the Young-Helmholtz theory of Colour-Vision.

The *stereophotochromoscope* is the product of a research by a physicist and photographer, who has solved one aspect (at least) of the problem of "photography in colours." Mr Ives does not, indeed, execute a coloured photograph on a card—and in this sense has not solved the problem of "photography in colours"—but he has constructed an instrument wherein we can reproduce in a mental picture the objects of the world around, not only in all their solidity, but, with a fidelity that is absolutely startling, their colours, tints, lights and shadows. Since, however, the novelty is not in its stereoscopic but its chromatic features, I need here only say that the essence of the process for reproducing coloured objects is, in the first place, the stereoscopic photographing of the coloured object; and secondly, the viewing of these photographs in coloured lights and under such optical conditions as to give the illusion[1] of a solid, coloured body.

There are, then, *two* instruments: a photographic camera for stereoscopically photographing the coloured object—as, for example, a basket of fruit and flowers; and secondly, the

[1] It must be premised that I use the term "illusion" as a technical term for a mental impression where the judgment predicates more than unaided sensation could warrant.